

DESCRIPTION OF A NAUTILOID, *PLEURONAUTILUS PULCHER*,
 N.SP., FROM THE CARBONIFEROUS ROCKS OF ENGLAND.

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PLATE II.

THE new species, *Pleuronautilus pulcher*, described in the present paper is based upon four examples and a fragment; of these, two and the fragment are in the British Museum collection, the others in the collection of Dr. Wheelton Hind, of Stoke-upon-Trent.

It may be characterized as follows:—Shell small, evolute, with the aperture only just in contact with the preceding whorl, thick-discoid, rapidly increasing in diameter, and having a central vacuity; greatest thickness at about the middle of the lateral area, from six- to seven-elevenths of the diameter of the shell; height of outer whorl from about four-elevenths to two-fifths of the diameter of the shell. Whorls two in number; inclusion very slight, but apparent at the completion of the first whorl; umbilicus deep, exposing the inner whorl, with steep sides and convex margin, from about two-fifths to about one-third of the diameter of the shell in width, and having a central vacuity. Whorl depressed elliptical or sub-tetragonal in cross-section, rather wider than high; scarcely indented by the preceding whorl; periphery broad, feebly convex, somewhat flattened in the centre and bevelled or even slightly concave on each side, separated from each lateral area by a narrow well-marked zone (the lateral ventral zone); sides rather narrow, somewhat flattened and divergent; umbilical shoulder rounded, ill-defined; inner area (or umbilical zone) convex, not sharply defined. Body-chamber occupying fully half of a whorl; aperture not seen, but, judging from the ornaments of the test, with a feeble sinus on the lateral area and a broad deep hyponomic sinus on the periphery. Chambers (cameræ) not very shallow, being near the base of the body-chamber about one-third of the height of the whorl in depth; suture-line with a feeble sinus on the lateral area, a broad shallow sinus on the periphery, and a small distinct dorsal or internal lobe. Siphuncle small, about two-fifths of the height of the whorl below the periphery apparently at all stages of growth. Test rather thick and beautifully ornamented; at about the end of the first half-whorl the shell becomes somewhat suddenly swollen, and two distinct longitudinal parallel ridges originate on each side of the peripheral area, the outer one on each side coinciding with the boundary of that area, and limit a distinct 'lateral ventral zone,' which is clearly defined almost to the aperture of the shell; at the same place there appear on the lateral area of the whorl feeble, broad, somewhat forwardly-inclined folds which become very prominent, forming almost a node, at the raised lateral margin of the lateral ventral zone; these folds soon assume the form of distinct

costæ, and near the commencement of the second whorl the inner or umbilical end of each costa becomes a little more swollen; near the base of the body-chamber this swelling diminishes, and before the completion of the second whorl, i.e. on the body-chamber, the outer nodes also disappear; then the folds themselves gradually become obsolete, the last half of the body-chamber being almost smooth. The whole of the surface of the test is ornamented with very fine regular raised lines; on the first half-whorl these lines pass obliquely backward across the lateral area and traverse the periphery in a deep broad backwardly-directed sinus; when the whorl suddenly becomes swollen the lines become more nearly direct, and on the rest of the shell they are parallel to the costæ over the lateral area and the lateral ventral zone as far as the margin of the periphery, whilst they cross the latter in a broad deep backwardly-directed sinus; in the adult the peripheral portion of the test bears also extremely faint longitudinal lines. The 'normal line' in the centre of the peripheral area is displayed in an internal cast, more especially on the body-chamber. Muscular attachment consisting of a finely punctated semi-oval area on each side close to the base of the body-chamber, that passes dorsally into a narrow punctated band which crosses the dorsal surface of the body-chamber, forming the impressed zone on a broad shallow sinus; ventrally the two semi-oval areas are connected by an exceedingly narrow, but apparently non-punctated band, crossing the peripheral area close to the edge of the base of the body-chamber. Epidermids consisting of very fine punctations, visible only with a very strong lens, that exhibit a tendency to dispose themselves in lines, which on the inner area (or umbilical zone) of the whorl pass rather more obliquely backward than, but elsewhere have the same direction as, the shell-ornaments.

The larger of the British Museum examples (No. C. 5277) has been selected as the type-specimen, because it displays all the characters of the species (Pl. II, Figs. 1-4). It is 27.5 mm. in diameter and consists of a little more than two whorls, the anterior part of the body-chamber leaving the coil very slightly; it has been broken in such a manner as permits of the examination of the different stages of growth of the shell. The first half-whorl, ornamented with simple reclined raised lines, constitutes the nepionic stage; this passes with a rather abrupt swelling into the neanic stage with its incipient costæ and distinct lateral ventral zone, and this in turn passes almost imperceptibly into the ephebic stage with its distinct nodose costæ, the gerontic stage being indicated on the internal cast of the body-chamber by the weakening of the ornaments and the gradual disappearance of the lateral ventral zone.¹ The

¹ In the Triassic example of *Pleuromutilus superbus* figured by Mojsisovics (Abhandl. d. k.-k. geol. Reichsanst., Bd. vi, 1873, pl. iv, figs. 1a-e) and Hyatt ("Phylogeny of an acquired characteristic": Proc. Amer. Philos. Soc., vol. xxxii, No. 143, 1894, pl. xii, fig. 3), the nepionic stage, consisting of an entire whorl, is also striated and passes quite abruptly into the costated neanic stage.

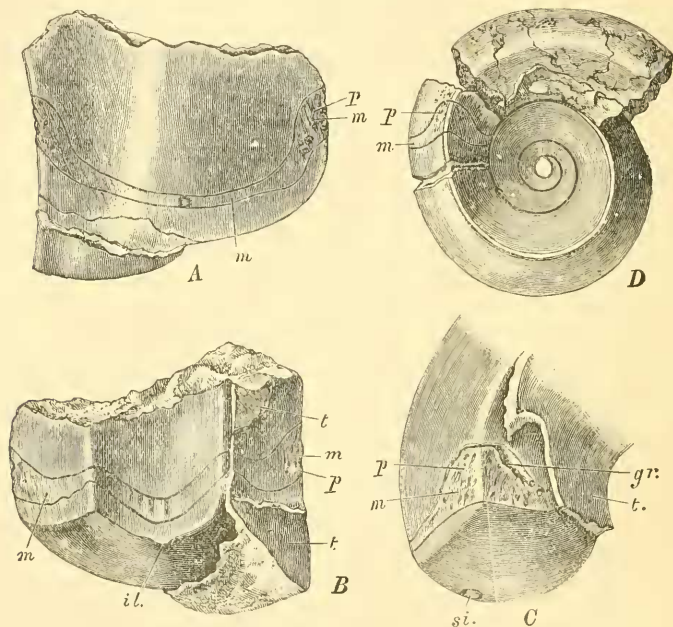
nepionic stage of the shell is preserved as an internal cast; it was not free, but abutted against the succeeding whorl; the test is wanting on its peripheral and lateral areas, but a fragment, with its characteristic sculpture, is preserved on the dorsal area, though the greater part of this area is concealed by matrix, which likewise obstructs the end view of the anepionic substage. There are, however, on the peripheral part of the tip of the internal cast of the first chamber indications of a vertical cicatrix. Even in the nepionic stage the cross-section of the whorl is depressed elliptical, a form which is maintained up to the base of the body-chamber. The siphuncle in the neanic stage, just before the end of the first whorl, is at about two-fifths of the diameter from the periphery, a position which it also occupies at the last septum, thus maintaining the same position in all stages of growth. The sculpture of the test of the ephebic stage is particularly well shown. The form of the muscular attachment is also displayed. On each side close to the base of the body-chamber there is a transverse semi-oval area, having its greatest height, 3 mm., at the lateral boundary of the lateral ventral zone; its broad ventral end, situated on the peripheral boundary of the same zone, is connected with the area on the opposite side by an exceedingly narrow band immediately above the last septum; dorsally each area gradually diminishes in width as far as the umbilical shoulder, i.e. for a distance of about 7 mm., whence it passes as a narrow band, somewhat wider than the ventral band and adjoining the edge of the last septum, across the suture of the shell or 'line of involution,' and over one-fourth of the width of the impressed zone, the rest of its course on the impressed zone being obscured by a film of the test. The semi-oval area on each side and the dorsal band are minutely punctated; the ventral band is so excessively narrow that it is difficult to say whether it is punctate or not, but puncturation appears to be lacking. The semi-oval area on one side bears two small pieces of shelly matter, the surface of which is also punctate. The form of the muscular attachment closely resembles that of *Vestinautilus cariniferus* (see accompanying figures). This specimen also shows the character of the epidermids. It belonged to the collection of the late J. W. Davis, of Halifax; the precise locality whence it was obtained has not been recorded, but the matrix agrees with that of the other examples which are from Hebden Bridge.

The smaller example in the British Museum collection (No. C. 213) belongs to the Gilbertson Collection, but in this case also the locality has not been recorded. It is 25 mm. in diameter; the inner whorl is fairly well preserved; the last third of the outer whorl is occupied by the body-chamber, but the greater part of this is imperfect both laterally and ventrally, so that the dimensions of the specimen can be best taken at a diameter of 21.5 mm. It exhibits very well the sculpture of the nepionic and neanic stages, and the suture-line in the ephebic stage.

The fragment in the National collection (No. C. 8631) is about 10 mm. long, and consists of the internal cast of the posterior portion of the body-chamber and of the two preceding cameræ; it is terminated

posteriorly by a septal surface, of which the ventro-dorsal diameter (= height of the whorl) is 6 mm., and the transverse (= thickness of the whorl) 8 mm., displaying the small internal (or dorsal) lobe, and the siphuncle at about two-fifths of the height of the whorl below the periphery. The specimen belonged to the collection of the late Mr. G. H. Morton, F.G.S., and is stated to be from the "Millstone Grit" of Hebden Bridge, Yorkshire.

FIGS. A, B, C, D.



Vestinautilus cariniferus, J. de C. Sowerby, sp., from the Carboniferous Limestone, Cork, Ireland.—*A.* Ventral or peripheral aspect of the internal cast of the posterior portion of the body-chamber (nat. size), showing at *m, m* the impression of the muscular attachment (*m* in all the other figures has the same meaning); *p* in all the figures refers to the pitted and rugose surface of the muscular impression. *B.* Dorsal (internal) aspect of the same fragment; *t*, test; *il.*, internal or dorsal lobe of a septum. *C.* Lateral aspect of the internal cast of the posterior portion of the body-chamber of a larger specimen; *t*, test; *gr.*, groove; *si.*, siphuncle. *D.* Reduced figure of a nearly perfect example of this species, from which the fragment lettered *A* and *B* was removed. (After Foord & Crick.) Reproduced by permission of the Trustees of the British Museum.

Dr. Wheelton Hind's examples are 17.5 and 27 mm. in diameter respectively. The smaller specimen is immature (Pl. II, Fig. 5); it consists of one and a half whorls, the body-chamber occupying nearly one-half of the outer whorl. The inner whorl is remarkably well preserved, and shows the ornaments of the test of the nepionic

and neanic stages, as well as the extent of the central vacuity; the aneponic shell is seen abutting against the succeeding whorl, but the terminal view of this substage is obstructed by matrix; at the end of the first whorl the shell has a diameter of 9.5 mm.

The larger example consists of two whorls; the inner whorl is less perfectly preserved than in the smaller specimen, and only portions of the test are present. There are nineteen or twenty costae in the outer whorl. The body-chamber occupies nearly one-half of the last whorl; the penultimate and antepenultimate chambers are each 2.5 mm. deep at the centre of the periphery, the whorl here having an altitude of 6.25 mm.; the last chamber is somewhat shallower than the penultimate, a fact which, notwithstanding the comparatively small size of the specimen, is usually regarded as a sign of maturity. On the whole this shell is rather stouter than the example selected as the type, but this may be due either to individual variation, or, as is more probable, to sexual difference.

The dimensions of the specimens arranged in the order of their respective greatest diameters are given in the following table; dimensions at other diameters being added for the sake of comparison. (I) is the smaller example in Dr. Wheelton Hind's collection; (II) the smaller specimen in the British Museum collection [No. C. 213]; (III) Dr. Wheelton Hind's larger example; (IV) the larger specimen (the type) in the British Museum collection [No. C. 5277]. The measurements are in millimetres.

TABLE OF DIMENSIONS.

	I		II			III			IV		
Diameter of shell	17.5	15	25 †	21.5	27	21.5	27.5	21.5	27.5	21.5	
Radius of shell *.....	10	9	14.5	13.5	9	17	14	9	16.5	13.5	9
Width of umbilicus ...	6.5	6	9.5	7.5	6	9.5	7.5	6	11	8	5.5
Height of outer whorl .	6	6	9	9	6	11.5	9	6	10	8.5	6.5
Thickness of outer whorl	8.5	6.5	?	12.5	8.5	17	14	9	15	13	10 ‡

With regard to the systematic position of the species, it seems to belong to Mojsisovics' genus *Pleuromutilus*¹ (emended by Foord²) except that in that genus, according to Foord, the siphuncle is a little below the centre, whereas in the present species it is a little above the centre in all stages of growth. The range of the genus is considered to be from the Devonian, where it is represented by *P. subtuberculatus*, G. & F. Sandberger,³ to the Trias, from which formation several forms have been described by Mojsisovics and others.

* I.e., a line drawn from the centre of the coil to the periphery of the shell.

† The last fourth of the whorl being imperfect both laterally and ventrally, these measurements are only approximate; they can be best taken where the diameter is 21.5 mm.

‡ Test well preserved on each side.

¹ E. v. Mojsisovics: "Die Cephalopoden der Mediterranen Triasprovinz" (Abhandl. der k.-k. geol. Reichsanst., Band x), 1882, p. 273.

² A. H. Foord: Cat. Foss. Ceph. British Museum, pt. ii (1891), p. 134.

³ G. & F. Sandberger: "Verstein. rhein. Schichtensyst. Nassau," 1854-56, p. 133, pl. xii, figs. 3a-e (*Nautilus tuberculatus*).

From *Pleuromutilus falcatus*, J. de C. Sowerby,¹ sp., and *P. subdistinctus*, A. H. Foord,² from the Coal-measures of Shropshire, the present species can be easily distinguished by the relatively greater width of the cross-section of its whorls, by the character of its ornaments, and by the straighter course of the peripheral portion of its suture-line.

The specimen figured as *Nautilus tetragonus* by J. Phillips in his "Geology of Yorkshire," pt. ii (1836), pl. xxii, fig. 34, may belong to the present species, but in the absence of the original it is not possible to arrive at a definite conclusion.

The only specimens known to the writer that are properly localised are from the Carboniferous rocks of Hebden Bridge, Yorkshire, where they occur in the Pendleside series.

EXPLANATION OF PLATE II.

- FIG. 1.—Lateral aspect of type-specimen in the British Museum collection (No. C. 5277) from the Carboniferous (Pendleside Series): probably Yorkshire. *ls* indicates the position of the last septum; immediately above this is seen the band of attachment, *sm* being the punctated area indicating the position of the shell-muscle, and *b* the narrow band connecting the ventral ends of the shell-muscles.
- „ 2.—Peripheral aspect of the same, showing also the band of attachment close to the base of the body-chamber; the lettering as in Fig. 1.
- „ 3.—Peripheral aspect of same, showing sculpture of the test.
- „ 4.—Anterior aspect of the last septal surface of the same, showing the position of the siphuncle (*si*), the lateral ventral zone (*lxz*), and the impressed zone (*imz*).
- „ 5.—Lateral aspect of the nepionic and neanic portions of an example in the collection of Dr. Wheelton Hind. The sudden swelling at the end of the first half whorl indicates the end of the nepionic stage. Carboniferous (Pendleside Series): Hebden Bridge, Yorkshire.

All the figures are drawn three times the natural size.

¹ J. de C. Sowerby: Trans. Geol. Soc. [2], vol. v, pt. 3 (1840), expl. of pl. xl, fig. 9 (*Nautilus falcatus*).

² A. H. Foord: Cat. Foss. Ceph. British Museum, pt. ii (1891), p. 139.